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Translocation and radio-telemetry monitoring of pygmy marmoset, *Cebuella pygmaea* (Spix, 1823), in the Brazilian Amazon

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(With 2 figures)

Abstract

Two groups of pygmy marmoset (*Cebuella pygmaea*) were rescued along the left bank of the Madeira River during the formation of Santo Antônio Hydroelectric Dam reservoir in the state of Rondônia, Northern Brazil. Reintroduction of both groups occurred in areas of open Tropical rainforest located within the project´s Permanent Preservation Area. A post-release monitoring was conducted for three months using radio-telemetry. Individuals of each group remained together and settled in stable home ranges near their respective release sites. The mortality rate of translocated animals was about 7%. This seems to be the first report documenting the complete group translocation of *C. pygmaea* and the first to successfully employ radio-telemetry techniques in monitoring this species. This study demonstrated the feasibility of translocation and the use of radio-telemetry in monitoring *C.* pygmaea.

Keywords: Cebuella pygmaea, translocation, radio-telemetry, wildlife rescue, conservation.

Translocação e monitoramento por radiotelemetria do mico-leãozinho, *Cebuella pygmaea* (Spix, 1823), na Amazônia brasileira

Resumo

Dois grupos de mico leãozinho (*Cebuella pygmaea*) foram resgatados ao longo da margem esquerda do Rio Madeira durante o enchimento do reservatório da Usina Hidrelétrica Santo Antônio, em Rondônia, norte do Brasil. A reintrodução de ambos os grupos deu-se em áreas de floresta ombrófila densa aberta dentro da Área de Preservação Permanente do empreendimento. Após a reintrodução, empregou-se a técnica de radiotelemetria para o monitoramento dos animais por aproximadamente três meses. Cada um dos grupos manteve-se coeso e estabeleceu suas áreas de vida em regiões próximas àquelas onde foram soltos. A taxa de mortalidade foi de aproximadamente 7%. Este parece ser o primeiro trabalho a documentar a translocação de grupos completos de *C. pygmaea* e o primeiro a empregar com sucesso a radiotelemetria no monitoramento desta espécie. Este estudo, portanto, demonstra a factibilidade da translocação e do uso da radio-telemetria para monitorar *C. pygmaea*.

Palavras-chave: Cebuella pygmaea, translocação, radiotelemetria, resgate de fauna, conservação.

1. Introduction

Defined as the movement of organisms between parts of its known native range (IUCN, 1987, 1995), wild animals translocation has been carried out in different situations, usually aiming to mitigate the negative effects of human actions over one or more species. Some of these situations include programs for species conservation, management of metapopulations and reintroduction after wildlife rescue (Griffith et al., 1989; Vié, 1999; Fischer and Lindenmayer, 2000; Trovati and Brito, 2009; Marques et al., 2011). In Brazil, translocations are commonly conducted during wildlife rescues, especially during the filling of reservoirs of hydroelectric plants, which have been occurring more frequently in recent decades and whose numbers are expected to increase in coming years (CNI, 2007; Alho, 2011).

Despite its recognized value as a conservation tool, the reintroduction of a species in areas where it already exists might bring risks to the populations involved, such as possible disease transmission, increase of the local

density and exclusion of individuals from the population (Woodford and Rossiter, 1993; Magnusson, 1995). Its use in wildlife rescue is also criticized by some researchers (Gribel et al., 1987; Rodrigues, 2006; Alho, 2011).

Fortunately there are some recommendations aiming to improve reintroduction operations with species conservation purposes (Konstant and Mittermeier, 1982; IUCN, 1987, 1995; Fischer and Lindenmayer, 2000). Among these recommendations, we highlight the importance of monitoring translocated species. According to Alho (2011) this approach is necessary to assess mortality rates, estimating the time spent in the establishment of a new home range and more importantly it allows the researchers to assess the success of the operation.

In Brazil however it is possible to note that few studies address the monitoring of mammals that have been translocated after wildlife rescue, especially during filling of hydroelectric reservoirs many of which are not documented (Neri et al., 1997; Rodrigues et al., 2001; Trovati and Brito, 2009; Marques et al., 2011). These published works employed radio-telemetry technique for monitoring translocated mammals. Radio-telemetry has made possible the study of various wildlife aspects, including those relating to the home range, mortality and survival rates, and migration rates (Ministry of Environment, Lands and Parks, 1998). This technique is especially useful when the studied species occurs in areas of difficult access, when it has nocturnal habits, when it is difficult to be followed or when it is shy of human observers (Fedigan et al., 1988). Some of these criteria are fulfilled by the species studied in this work.

The pygmy marmoset, *Cebuella pygmaea* (Spix, 1823), is the smallest Neotropical primate species (Townsend, 2001). It inhabits lowland evergreen forests of the western Amazon, usually on flood plains (Townsend, 2001). In Brazil, it occurs only in the states of Acre, Amazonas and Rondônia, and in the latter state their presence has just been recently confirmed (Messias et al., 2011). The species feeds primarily on arthropods and plant exudates, however other food items may also be included such as fruits, buds, flowers and nectar (Soini, 1982). The availability of these resources will directly influence the size of the home range of *C. pygmaea,* whose recorded values range from 0.1 to 1.3 ha (Ferrari and Lopes Ferrari, 1989; Townsend, 2001).

This study is the first to document the translocation of *C. pygmaea* complete groups after they had been rescued from flooded areas during the filling of the reservoir of a hydroelectric plant and it is also the first to document a primate translocation operation in the Brazilian Amazon rainforest. The aim of this study is to assess the feasibility of translocation and radio-telemetry monitoring of the pygmy marmoset, the survival of the animals after release in a new area and the time required to the establishment of a new home range.

2. Material and Methods

2.1. Study area

This study was conducted in the area of influence of the Santo Antônio Hydroelectric Plant, located near the city of Porto Velho, capital of Rondônia state, Northern Brazil. The study area is located on the Madeira River Basin, Western Amazon. This region presents tropical wet climate (Aw, according to the Köppen climate classification) and it has annual rainfall average between 2200 and 2400 mm. The characteristic vegetation is the open Tropical rainforest, which is the main vegetation type affected by the formation of the hydroelectric dam reservoir. The size of the total flooded area was about 208 km^2.

2.2. Rescue and reintroduction

Two groups of *C. pygmaea*, group A (composed of five individuals) and group B (composed of nine individuals), were rescued in two locations along tributaries on the left bank of Madeira River during the formation of the Santo Antônio Hydroelectric Dam reservoir (Table 1) as part of Santo Antônio Energia's Wildlife Rescue Program. The animals were rescued in small vegetation patches isolated from the river's bank due to the formation of the reservoir. Since the rescue sites undergone prior vegetation removal and these areas were almost entirely covered by the reservoir's water at the time the animals were rescued, we could only describe the rescue sites vegetation type based on floristic and phytosociological surveys conducted on Porto Velho (Rondônia) (SEDAM, 2002; Nascimento et al., 2007; Santos, 2007; MMA, 2007; Reis, 2007; Pansini, 2008; Silva and Bentes-Gama, 2008). These areas were covered by flooded forests characterized by the presence of a high canopy, spaced understory and the moderate presence of lianas (SEDAM, 2002; MMA, 2007).

The animals were taken to Santo Antônio Energia's Wild Animals Screening Center - WASC (Centro de Triagem de Animais Silvestres – CETAS), where they were examined by veterinarians, weighed and sexed. One adult male and one adult female from each group were

Table 1. Rescue and release sites geographical coordinates, number of individuals per sex, radio-tagged animals and rescue dates.

	Rescue site coordinates	Release site coordinates	Number of individuals /Sex	Animals with radio transmitters	Rescue date
Group A	8°51'23.62"S / 64° 4'22.07"W	8°52'48.30"S / 64° 6'1.83"W	3 males	MA	30/11/2011
			2 females	FA	
Group B	9° 5'19.59"S / 64°20'50.58"W	9° 6'58.68"S / 64°32'35.28"W	5 Males	MB	8-13/12/2011
			4 females	FB	

sedated with 10 mg/kg ketamine so they could receive the collars containing radio transmitters (Table 1); these four animals also had their temperature and main body measurements assessed.

In order to verify the acceptance of the collar, as well as the reaction to the anesthetic, the animals were kept under observation for 18 days in the WASC, so that each group was kept in separate enclosures. Once veterinarians certified the good condition of the animals, they were released following the recommendations proposed by Konstant and Mittermeier (1982), IUCN (1987, 1995) and Griffith et al. (1989).

Reintroduction of both groups occurred in areas of open Tropical rainforest situated within the Permanent Preservation Area pertaining to Santo Antônio Hydroelectric Plant (Table 1 and Figure 1).

Release sites were visited by biologists before they were chosen. The selection process was based on some criteria aiming to raise the chances of success of translocated groups, in the selection process we proceeded as follows: i) based on data from SEDAM (2002) and MMA (2007) and local people survey; We searched for suitable sites in areas covered by lowland Tropical rainforest in locations along tributaries on the left bank of Madeira River. These areas were necessarily covered by flooded forests characterized by the presence of a high canopy, spaced medium to low understory and the moderate presence of lianas. ii) Field surveys, local people interview and/or data from technical reports were employed to verify the absence of resident groups of *C. pygmaea* in the selected areas. In field surveys we searched for feeding holes on tree trunks and we also tried to attract putative resident pygmy marmoset individuals using playback of *C. pygmaea* vocalizations available in Emmons and Feer (1997). iii) We also verified in literature the presence of plant genera that could possibly be used as exudate source by the reintroduced group, including genera that were already reported as exudate source for the pygmy marmoset such as *Ceiba*, *Inga* Miller*, Parkia* R. Brown*, Trichilia* P. Browne*, Tapirira* Aublet*, Vochysia* Aublet (Soini, 1982; Soini and Soini 1990; Nascimento et al., 2007; Santos, 2007; Reis, 2007; Pansini, 2008; Silva and Bentes-Gama, 2008).

We employed no post-release support, such as supplemental feeding or protection from predators.

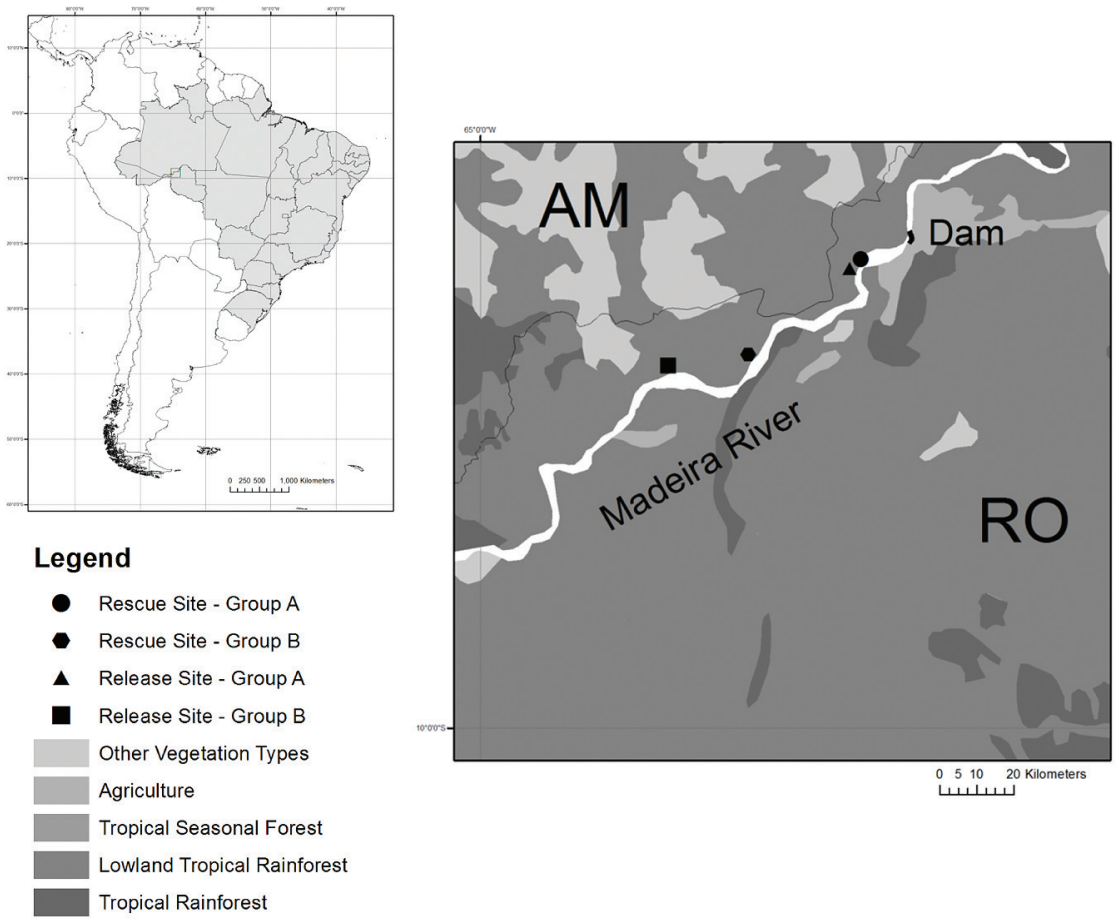

Figure 1. Study Area and Release sites. Circle and triangle represent, respectively group A rescue and release sites. Hexagon and square represent, respectively group B rescue and release site.

2.3. Monitoring and data analysis

Monitoring activities occurred from January to May 2012 and were conducted until the radio transmitters ran out of batteries. We used miniature mammal collars, model M1610 and R410 receivers, all equipment from ATS. In order to avoid interference from external noise during reception of radio signals, headphones were coupled to the receptor.

Counting on from the day the animals were reintroduced, they were monitored for eight consecutive days, so that each group was accompanied by a team. From then on, monitoring was conducted in a weekly regimen, so that each group was accompanied by a team for one day a week. For each monitoring day we recorded: radio frequency, date, time and geographical coordinates referring to the position where the animals were observed, which were established by triangulation or by direct observation of the animal.

Groups remained cohesive after release, so that males and females carrying the radios transmitters invariably occupied the same areas. Thus we chose to perform the home range and displacement calculation for each group rather than to make them for each radio-tagged individual. Data were analyzed using the software R (R Core Team, 2012) and the package adehabitatHR (Calenge, 2006). The home range was estimated by the method of Minimum Convex Polygon (MCP) (Mohr, 1947) trimmed at 85% to 95% fixes (Schoener, 1981; White and Garrot, 1990).

3. Results

The release of group A was conducted in a site located about four kilometers from that where it was rescued, while group B was reintroduced in an area about twenty kilometers distant from the area of rescue. We certified that both groups were reintroduced in habitats similar to those where they were rescued i.e. flooded forests characterized by the presence of a high canopy, spaced medium to low understory and the moderate presence of lianas locations along tributaries on the left bank of the Madeira River where the absence of resident groups of pygmy marmoset were confirmed. In order to ensure the safety of animals released and to make a less stressful release process, both groups were released in areas of the forest that were not covered by water (since it was rainy season, at the time, most of the forest near to the river bank was flooded).

Group A displaced approximately 840 m (straight line) from the release site to the farthest point reached during monitoring period, this route was performed in about 27 days. Group B moved about 660 m (straight line) from the release site until the last relocation point recorded during monitoring period, spending approximately 44 days to complete this route. Both groups made use of adjacent areas to their release sites (Figure 2, Table 2), following a pattern of successive occupation of small home ranges (Soini, 1982). Group A remained for 24 days making use of an area (home range IA) of 0.78 ha before occupying its definitive home range (home range IIA). Group B remained for nine days in an area (home range IB) of approximately 1 ha. This group also made use of another area (home range IIB) of 0.12 ha, 450 m away from the release point, before establishing its new definitive home range (home range IIIB). However as these areas were used for shorter periods (home ranges: IA, IB and IIB) they were not included in the calculation of the definitive home ranges of the respective groups, which was calculated only after we noted that groups reduced their displacement level.

For group A, the estimated definitive home range size was about 1.3 ha and it was occupied by the group for 85 days during the study period. Group B had its estimated home range size at 1.05 ha, which was occupied for 52 days. For both groups, the time spent in establishing the new home range was similar to that observed for other primate species (Richard-Hansen et al., 2000; Marques et al., 2011).

During the eighth week after monitoring had started, the contact with male MB was lost. From then on it was not possible to locate it, once it was not part of group B anymore. Despite some trials to locate male MB in nearby areas, no other register of this individual was recorded. Neither signs of predation nor possible remnants of the radio transmitter were found, since the latter was inoperative.

After the monitoring period, we found that little had changed with regard to the groups composition. Group A remained with the same five individuals and group B that was initially composed of nine individuals finished the monitoring period with eight.

4. Discussion

Richard-Hansen et al. (2000) enumerate some aspects that can be used to evaluate the success of animal reintroduction operations. Some of those could be evaluated in this study, such as the survival rate of animals and their permanency at the release site, Rogers (1988) even suggests that the latter is one of the factors that influence the success of the reintroduction.

Table 2. Homerange, size, number of days a home range has been occupied and distance to the release point.

Group	Area	Size (ha)	ocupation (days)	Distance in relation to the release point (m)
A	IA	0.78	24	NA
	IIA	1.24	85	840
B	IB	1.06	9-14	NA
	IIB	0.12	30	450
	IIIB	1.05	52	660

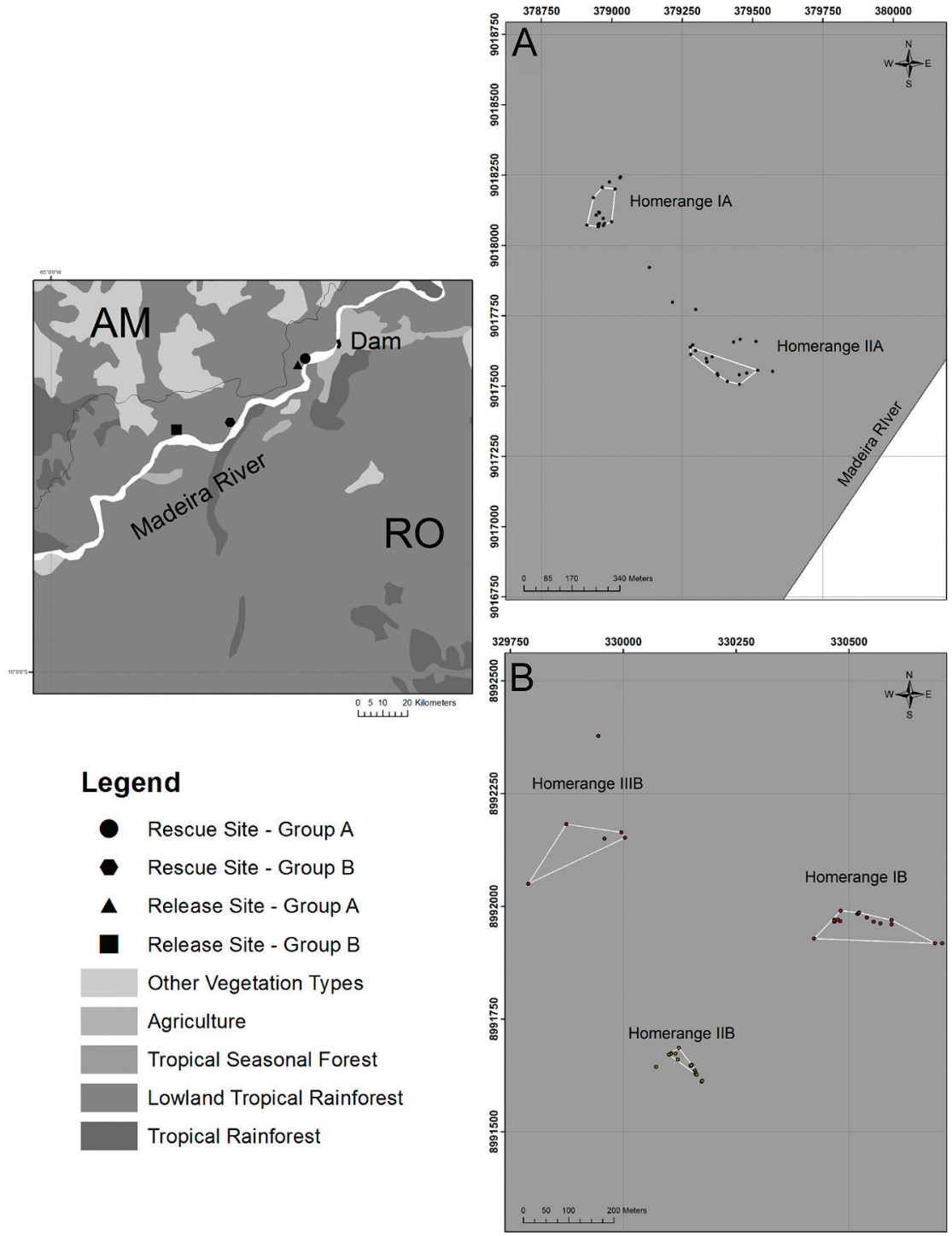

Figure 2. Home ranges of translocated pygmy marmoset groups. A) Group A home ranges. B) Group B home ranges. For sizes see Table 2. Small dots in Figures A and B represent the observation points.

Both *C. pygmaea* groups established their home ranges near their respective release sites. We considered the displacement reported in this study not surprising, since the maximum distances displaced by the groups along this study were not excessive when compared to the total horizontal movement capacity of the species, that averages from 280-300 m per day (Soini, 1982). Besides, it seems that large animal displacements (i.e. distances bigger than twice its home range) are commonly reported for translocated mammals where there is no post-release

support (Rodrigues et al., 2001; Richard-Hansen et al.,2000; Trovati and Brito, 2009; Marques et al., 2011). As reported by Marques et al. (2011), exploratory behavior is more frequently observed right after release. We believe that at this initial moment released animals forage in an unknown environment, where they probably lack spatial references that may lead them to low success while searching for food or roosting sites.

There was no evidence of homing although that could not be significantly tested in this study, though it was possible to note that the animals moved toward the forest regions that were closer to the banks of water courses and not toward their original sites. The observation that both groups occupied successively different home ranges corroborates the results of previous studies and reinforces the hypothesis that *C. pygmaea* seems to exhibit a pattern of space use that optimizes resource exploitation (Soini, 1982). Home range sizes estimated here for both groups of *C. pygmaea* are higher than the 0,5 ha maximum homerange size reported by Soini (1982). This result in part is due to the use of radio-telemetry, whose use in primate studies can raise the chances of finding monitored individuals (Fedigan et al., 1988). In addition, radio-telemetry facilitates the location of individuals in outlying areas of their home ranges (Richard-Hansen et al., 2000). Another factor that may be associated with the bigger home range sizes estimated here is the resources availability. Despite it has not been tested, it directly influences the home range size in *C. pygmaea,* which seems to occupy smaller home ranges if there are abundant exudate sources (Ferrari and Lopes Ferrari, 1989).

At the end of the monitoring period, we lost contact with only one individual, as explained before. It was not possible to determine whether it died or it separated from its group, since dispersal of mature individuals is a common behavior observed in pygmy marmoset (Soini, 1982; Ferrari and Lopes Ferrari 1989). Also, we stopped detecting this individual in a time when the radio transmitter was running out of batteries (according to the manufacturer instruction). If we consider it was dead, we can say the mortality rate of translocated animals during the period of this study was about 7%.

This seems to be the first documented report of *C. pygmaea* complete group translocation and the first to successfully employ radio-telemetry techniques in monitoring this species, an approach that has been applied with some problems in other primate species (Müller and Schildger, 1994; Neri et al., 1997; Richard-Hansen et al., 2000). In this study we could demonstrate the feasibility of translocation and the use of radio-telemetry in monitoring *C. pygmaea*. We believe that the satisfactory results expressed by the low mortality rate, and small post release displacement distances are due to the fact that we have followed the recommendations from Konstant and Mittermeier (1982), IUCN (1987, 1995) and Griffith et al. (1989), such as the choice of an area where the habitat requirements of *C. pygmaea* were satisfied (i.e. flooded forest areas where resident groups of pygmy marmoset were absent and exudate source plants were present); the release in areas where protective measures were in effect (once the groups were released in Permanent Preservation Areas) and the translocation of intact social groups, an approach that has been proved to increase the survival rates (Marques et al., 2011).

Since much of the relocation literature is not generally accessible to wildlife managers and conservation biologists (Fischer and Lindenmayer, 2000), we believe this study may help the understanding of processes underlying the rescue and translocation of wild animals. Furthermore it reinforces how important may be the role played by rescue and translocation of animals in mitigating anthropogenic impacts. As Vié (1999) and Fischer and Lindenmayer (2000) we also believe, given the impact of this project on the media, that wildlife rescue can be an excellent way to attract public attention to conservation issues.

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References

ALHO, CJR., 2011. Environmental effects of hydropower reservoirs on wild mammals and freshwater turtles in Amazonia: A review. *Oecologia Australis*, vol. 15, no. 3, p. 593-604.

CALENGE, C., 2006. The package adehabitat for the R software: a tool for the analysis of space and habitat use by animals. *Ecological Modelling*, vol. 197, p. 516-519.

Confederação Nacional da Indústria – CNI, 2007. *Matriz energética: cenários, oportunidades e desafios*. Brasília: CNI. 82 p.

EMMONS, LH. and FEER, F.,1997. *Neotropical rainforest mammals: A field guide*. Chicago: University of Chicago Press. 307 p.

FEDIGAN, LM., FEDIGAN, L., CHAPMAN, C. and GLANDER, KE., 1988. Spider monkey home ranges: A comparison of radio telemetry and direct observation. *American Journal of Primatology*, vol. 16, no. 1, p. 19-29. http://dx.doi.org/10.1002/ajp.1350160104.

FERRARI, SF. and LOPES FERRARI, MA., 1989. A re-evaluation of the social organisation of the Callitrichidae, with reference to the ecological differences between genera. *Folia Primatologica (Basel)*, vol. 52, no. 3-4, p. 132-147. http://dx.doi.org/10.1159/000156392. PMid:2515129

FISCHER, J. and LINDENMAYER, DB., 2000. An assessment of the published results of animal relocations. *Biological Conservation*, vol. 96, no. 1, p. 1-11. http://dx.doi.org/10.1016/S0006-3207(00)00048-3.

GRIBEL, R., MOREIRA, G., MARTINS, M., LEMES, M., COLARES, E. and EGLER, S., 1987. Destinos da fauna de Balbina. *Ciência Hoje*, vol. 6, no. 31, p. 76.

GRIFFITH, B., SCOTT, J.M., CARPENTER, J.W., REED, C., 1989. Translocation as a species conservation tool: status and

strategy. *Science*, vol. 245, p. 477-480. http://dx.doi.org/10.1126/science. 245.4917.477. PMID: 17750257.

International Union for Conservation of Nature – IUCN, 1987. *Position statement on the translocation of living organisms: Introductions, re-introduction and re-stocking*. Gland: IUCN.

International Union for Conservation of Nature – IUCN, 1995. *Draft guidelines for re-introductions. IUCN/Species Survival Comission – The World Conservation Union*. Gland: IUCN.

KONSTANT, WR. and MITTERMEIER, RA., 1982. Introduction, reintroduction and translocation of Neotropical primates: past experiences and future possibilities. *International Zoo Yearbook*, vol. 22, no. 1, p. 69-77. http://dx.doi.org/10.1111/j.1748-1090.1982.tb02010.x.

MAGNUSSON, WE., 1995. Reintrodução: Uma ferramenta conservacionista ou brinquedo perigoso? *Neotropical Primates*, vol. 3, p. 82-84.

MARQUES, AAB., SCHNEIDER, M. and ALHO, CJR., 2011. Translocation and radio telemetry monitoring of black-tailed marmosets, *Callithrix (Mico) melanura* (É. Geoffroy in Humboldt), in a wildlife rescue operation in Brazil. *Brazilian Journal of Biology*, vol. 71, no. 4, p. 983-989.

MESSIAS, MR., CORAGEM, JT., GOMES, ISR., OLIVEIRA, MA., BONAVIGO, PH., NIENOW, SS. and SOUZA, ES., 2011. Southern extension of the geographical range of the pygmy marmoset *Cebuella pygmaea niveiventris* (Lönnberg, 1940) in the southwestern Amazon Basin, state Rondônia, Brazil. *Neotropical Primates*, vol. 18, no. 1, p. 30-31. http://dx.doi.org/10.1896/044.018.0107.

Ministério do Meio Ambiente – MMA, 2007. *Mapa de cobertura vegetal dos biomas brasileiros*.

Ministry of Environment, Lands and Parks, 1998. *Wildlife radio-telemetry: Standards for Components of British Columbia's Biodiversity no. 5*. British Columbia: Resources Inventory Comitee. 118 p. Version 2.0.

MOHR, CO., 1947. Table of equivalent population of North American small mammals. *American Midland Naturalist*, vol. 37, no. 1, p. 223-449. http://dx.doi.org/10.2307/2421652.

MÜLLER, KH. and SCHILDGER, J., 1994. Capture and radio-telemetry of masked titi monkeys, *Callicebus personatus melanochir. Neotropical Primates*, vol. 2, no. 4, p. 7-8.

NASCIMENTO, RF., PANSINI, S., SANTOS, NB., NEIRA, MPC., REIS, NFC., MANZATO, A.G. and BERNARDI, J.V.E., 2007. Variações florísticas, estruturais e fenologia de um trecho de floresta ombrófila aberta no estado de Rondônia – Brasil. In: Anais do 58º Congresso Brasileiro de Botânica, 2007. São Paulo. São Paulo.

NERI, FM.; RYLANDS, AB.; FRAIHA, V.T., FERREIRA, M.B., 1997. Utilização de rádio telemetria em sauás, *Callicebus personatus,* resgatados durante a implantação da Usina Hidrelétrica Nova Ponte, Minas Gerais. *Neotropical Primates*, vol. 5, no. 2, p. 50-52.

PANSINI, S., 2008. *Variações florísticas, estruturais e fenologia de um trecho de floresta ombrófila aberta no estado de Rondônia – Brasil*. Porto Velho: Departamento de Ciências Biológicas, Fundação Universidade Federal de Rondônia. Monografia.

R CORE TEAM, 2012. *R: A language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing. Available from: <http://www.r-project.org/>. Access in: 16 Dez. 2012.

REIS, NFC., 2007. *Estrutura fitossociológica de um trecho da floresta ombrófila aberta localizado no campus universitário José Ribeiro Filho, Porto Velho – RO*. Porto Velho: Departamento de Ciências Biológicas, Fundação Universidade Federal de Rondônia. Monografia.

RICHARD-HANSEN, C., VIÉ, J-C. and DE THOISY, B., 2000. Translocation of red howler monkeys (*Alouatta seniculus*) in French Guiana. *Biological Conservation*, vol. 93, no. 2, p. 247-253. http://dx.doi.org/10.1016/S0006-3207(99)00136-6.

RODRIGUES, FHG., MARINHO-FILHO, J. and SANTOS, HG., 2001. Home ranges of translocated lesser anteaters *Tamandua tetradactyla* in the cerrado of Brazil. *Oryx*, vol. 35, no. 02, p. 166-169. http://dx.doi.org/10.1017/S0030605300031732.

RODRIGUES, M., 2006. Hidroelétrica, ecologia comportamental e resgate de fauna: uma falácia. *Natureza & Conservação*, vol. 4, no. 1, p. 29-38.

ROGERS, LL.,1988. Homing tendencies of large animals: A review. In NIELSEN, L. and BROWN, RD. (Eds.). *Translocations of wild animals*. Milwaukee: Wisconsin Humane Society and Caesar Kleberg Wildlife Research Institute. p. 76-92.

SANTOS, NB., 2007. *Análise da estrutura fitossociólogica da comunidade arbustiva e arbórea de uma floresta ombrófila densa aluvial no município de Porto Velho, Rondônia*. Porto Velho: Departamento de Ciências Biológicas, Fundação Universidade Federal de Rondônia. Monografia.

SCHOENER, T.W., 1981. An empirically based estimate of home range. *Theoretical Population Biology*, vol. 20, p. 281-325.

Secretaria de Estado do Desenvolvimento Ambiental – SEDAM, 2002. *Atlas Geoambiental de Rondônia*. 2a. ed. Porto Velho: Governo do Estado de Rondônia.

SILVA, APFF. and BENTES-GAMA, MM., 2008. Fitossociologia de uma floresta ombrófila aberta em área de assentamento rural no distrito de Jaci Paraná, Porto Velho, Rondônia. *Ambiência*, vol. 4, no. 3, p. 435-452.

SOINI, P. and SOINI, M., 1990. Un estudio y saca experimental de Cebuella pygmaea. In Ministerio de Agricultura, Ministerio de Salud and Organización Mundial de la Salud. (Eds.). *La Primatologia en el Peru. Investigaciones primatológicas (1973-1985)*. Lima: Imprenta Propaceb. p. 104-121. Proyecto Peruano de primatología "Manuel Moro Sommo".

SOINI, P., 1982. Ecology and population dynamics of the pygmy marmoset, Cebuella pygmaea. *Folia Primatologica (Basel)*, vol. 39, no. 1-2, p. 1-21. http://dx.doi.org/10.1159/000156066. PMid:6815036

TOWNSEND, WR., 2001. Callithrix pygmaea. *Mammalian Species*, vol. 665, p. 1-6. http://dx.doi.org/10.1644/1545-1410(2001)665<0001:CP>2.0.CO;2.

TROVATI, RG. and BRITO, BA., 2009. Nota sobre deslocamento e área de uso de tamanduá-mirim (*Tamandua tetradactyla*) translocado no Cerrado brasileiro. *Neotropical Biology and Conservation*, vol. 4, no. 3, p. 144-149. http://dx.doi.org/10.4013/nbc.2009.43.04.

VIÉ, JC., 1999. Wildlife rescues – The case of the Petit Saut hydroelectric dam in French Guiana. *Oryx*, vol. 33, p. 115-126.

WHITE, GC. and GARROT, RA.,1990. *Analysis of wildlife radio-tracking data*. San Diego: Academic Press. 383 p.

WOODFORD, MH. and ROSSITER, PB., 1993. Disease risks associated with wildlife translocation projects. *Revue Scientifique et Technique de l'Office International des Epizooities*, vol. 12, no. 1, p. 115-135. PMid:8518439.